Magic Bullet: Real-Time Anytime Treatment Learning, Phase I

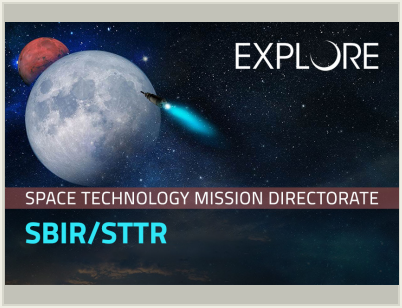
Completed Technology Project (2005 - 2005)

Project Introduction

Quality vehicle health management systems are critical to the successful operation of modern sounding rockets, and other unmanned vehicles. Unfortunately, the software of these systems tends to be complex and rigid and thus expensive and failure-prone, especially given the several real-time constraints of rocketry. We propose to develop the ``Magic Bullet'' Adaptive Intelligent Vehicle Health Management (AIVHM) System, a novel adaptive control system for sounding rockets based on the technologies of treatment learning and Bayes classification. This system will be able to derive an appropriate control strategy for a vehicle in the event of partial system failure. Our relationship with the Portland State Aerospace Society (PSAS) provides us with a unique opportunity to evaluate and deploy these methods at extremely low cost and with extremely low risk, for simulation and even actual flight testing. The PSAS LV2 rocket has a navigation and control system architecture ideally suited to experimentation with the proposed system. As senior technical advisory to PSAS, our organization is well-positioned to prototype and deploy the Magic Bullet AIVHMs technology with PSAS. We expect this deployment to result in the information needed to scale the technology to larger, more complex, more demanding avionics applications.

Anticipated Benefits

Because of its expected simplicity and low cost, the Magic Bullet technology should be of near-term interest to commercial developers of inexpensive, high quality avionics. Groups exploring Unmanned Aerial Vehicle avionics (including NASA) should find the AIVHMS useful. Indeed, almost any kind of unmanned autonomous vehicle, including land and underwater craft, should be able to benefit from Magic Bullet. While it may be difficult to safety-qualify the Magic Bullet AIVHMS as a primary controller for human flight in the short term, it should nonetheless be usable in controlled-responsibility ancillary systems for commercial avionics. The Magic Bullet AIVHMS is highly general: it should be useful wherever autonomous vehicles with intelligent VHM are required. Sounding rockets within NASA and elsewhere are prime candidates for the the AIVHMS. We believe that there is a strong potential for NASA to contract for either COTS avionics navigation and control packages containing Magic Bullet technology, or for consulting to apply the technology in-house.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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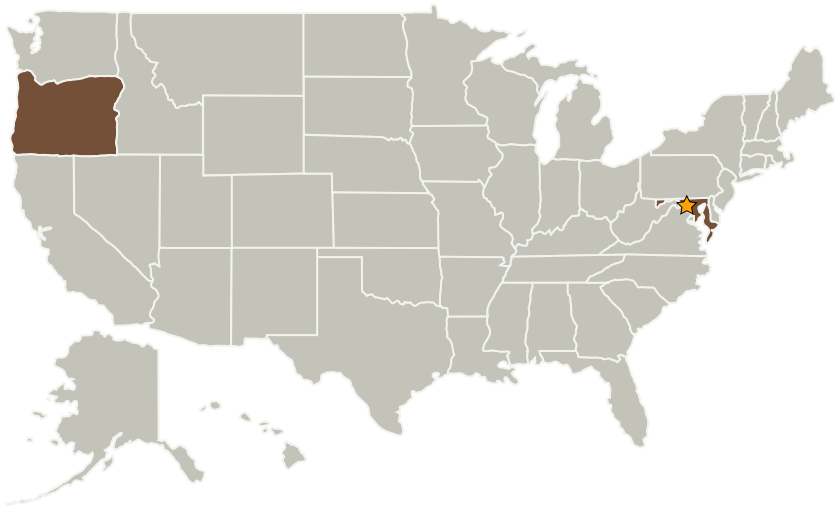
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
bart-massey.com LLC	Supporting Organization	Industry	Lake Oswego, Oregon

Primary U.S. Work Locations	
Maryland	Oregon

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Dan Solomon

Principal Investigator:
Tim J Menzies

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.3 Mission Operations and Safety
    - TX07.3.2 Integrated Flight Operations Systems